## Claims

[c1] 1. A cooling system for a vehicle powertrain having a motor and a transmission comprising:

said motor having a stator housing;

a cooling loop in heat conductive contact with said motor stator housing and with said transmission;

said cooling loop comprising a heat exchanger and conduits providing a fluid flow connection between said motor stator housing said transmission, and said heat exchanger; and

said cooling loop further comprising a mechanical transmission pump and an auxiliary pump.

[c2] 2. The cooling system of claim 1, further comprising a controller for receiving and processing input from at least one vehicle sensor, and for commanding said auxiliary pump to operate when the processed input of at least one vehicle sensor exceeds a pre-selected threshold.

[c3] 3. The cooling system of claim 2, wherein the controller is a vehicle system controller.

[c4] 4. The cooling system of claim 2, wherein:

said cooling loop further comprises bypass conduits and bypass valves having actuators independently controllable by the controller to operate when the processed input from at least one vehicle sensor exceeds a pre-selected threshold; and

said auxiliary pump is reversible.

[c5] 5. The cooling system of claim 1, wherein the motor is an integrated-starter-generator.

[c6] 6. The cooling system of claim 1, wherein the powertrain is arranged in a series configuration.

[c7] 7. The cooling system of claim 1 wherein the auxiliary pump is internal to the transmission.

[c8] 8 The cooling system of claim 1 wherein the auxiliary pump is external to the transmission.

[c9] 9. The cooling system of claim 1, wherein the cooling loop is configured to maintain a transmission temperature at no greater than 250 degrees Fahrenheit and a temperature for said motor at no greater than 630 degree Fahrenheit.

[c10] 10. The cooling system of claim 1, wherein the stator housing is overlapped by a transmission housing.

[c11] 11. The cooling system of claim 1, wherein the stator housing is adjacent to a transmission housing.

[c12] 12. A vehicle comprising:

a powertrain having a motor and a transmission;

a cooling loop in heat conductive contact with said motor stator housing and with said transmission;

said motor having a stator housing;

said cooling loop comprising a heat exchanger and conduits to connect said motor stator housing, transmission, and heat exchanger; and

said cooling loop further comprising a mechanical transmission pump and an auxiliary pump.

[c13] 13. The vehicle of claim 12, wherein said vehicle is a hybrid electric vehicle.

[c14] 14. A system to control cooling a vehicle powertrain having a motor and a transmission comprising:

at least one sensor provided within said powertrain for issuing an output signal;

a controller operatively connected to the at least one sensor;

a combined motor and transmission cooling loop comprising a heat exchanger and conduits to connect said motor stator housing, transmission, heat exchanger, a mechanical transmission pump and an auxiliary pump; and

a program of control logic embodied within the controller to interpret said signal and to issue a command signal based on said interpretation to

control said auxiliary pump to operate when the processed input of at least one vehicle sensor exceeds a pre-selected threshold.

[c15] 15. A method of cooling a vehicle powertrain having a motor and a transmission comprising the step of pumping coolant through a cooling loop which is in heat conductive contact with a motor stator housing in said motor and with said transmission.

[c16] 16. The method of claim 15, further comprising the step of:

receiving and processing input of at least one vehicle sensor output; and

commanding an auxiliary pump to operate when the processed input of at least one vehicle sensor exceeds a pre-selected threshold.